CLAIMS:

1. A junction structure between a semiconductor waveguide region and a first dielectric forming a further waveguide region of lower refractive index than said semiconductor waveguide region, which structure comprises a light transmitting semiconductor layer having an end face at said junction, and a substrate below the semiconductor layer and extending beyond said junction and a first dielectric light transmitting layer formed over the extending part of the substrate and extending in alignment with the semiconductor layer to provide the further waveguide region, wherein a second dielectric layer of refractive index below that of the two waveguide regions is formed over the end face of the semiconductor and over the extending part of the substrate, thereby forming a support layer of required thickness for the further waveguide region to provide the required alignment of the optical axis through the two waveguide regions.

2. A junction structure between silicon and silicon nitride in a waveguide, which structure comprises a light transmitting silicon layer having an end face at said junction, and a substrate below the silicon layer and extending beyond said junction and a silicon nitride light-transmitting layer formed over the extending part of the substrate and extending as a further waveguide region in alignment with the silicon layer, wherein a dielectric layer of refractive index below that of silicon and silicon nitride is formed over the end face of the silicon between the silicon and the silicon nitride and over the extending part of the substrate, thereby forming a support layer of required thickness for the silicon nitride to provide the required alignment of the optical axis through the silicon nitride with the optical axis through the silicon.

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3. A junction structure according to claim 1 or 2, wherein the dielectric layer below the further waveguide region is silicon dioxide.

4. A junction structure according to claim 2 or claim 3, wherein the substrate comprises a layer of silicon dioxide and a layer of silicon.

5. A junction structure according to any of claims 2 to 4, wherein the dielectric layer also extends over the light transmitting semiconductor layer.

6. A junction structure according to claim 5, wherein the silicon nitride layer also overlies the dielectric layer over the light transmitting semiconductor layer.

7. A junction structure according to any of claims 2 to 6, wherein there is provided an anti-reflective layer over said end face.

8. A junction structure according to claim 7, wherein the anti-reflective layer is silicon nitride.

9. A junction structure according to claim 7 or claim 8, wherein the light transmitting semiconductor layer is directly covered by a layer of silicon dioxide on the side remote from the substrate.

10. A junction structure according to any of claims 2 to 9, wherein the layer forming the further waveguide region is patterned.

11. A junction structure according to any of claims 2 to 10, wherein the waveguide regions are in the form of rib waveguides.

12. A junction structure according to any of claims 2 to 11, wherein the silicon nitride layer is of sub-micron thickness and is less than one tenth the thickness of the silicon layer.

13. A junction structure according to any one of the preceding claims in which the said end face of the semiconductor waveguide

at the junction is curved and forms a lens to direct transmitted light into the adjacent waveguide section.

14. An optical interferometer having parallel light transmitting paths, at least one of said paths including a waveguide junction structure as claimed in any one of claims 1 to 13.

15. An optical interferometer according to claim 14 in which said one of the paths includes a silicon waveguide having a section of its length in which the light transmitting layer is formed of a region of silicon nitride, a silicon to silicon nitride junction being formed at each end of said section and aligned with an optical path through the waveguide.

16. An interferometer according to claim 15, wherein each of the said paths includes a silicon waveguide formed by a light-transmitting layer of silicon on an insulating layer.

17. An interferometer according to claim 15 or claim 16, wherein the or each silicon waveguide is a rib waveguide formed from a silicon-on-insulator wafer.

18. An interferometer according to any of claims 15 to 17, wherein the insulating layer is silicon dioxide.

19. A method of forming a junction structure between semiconductor and a first dielectric in an aligned region of a waveguide, the method comprising the steps of:

forming a semiconductor waveguide having an end face at said junction on a substrate below a light transmitting semiconductor layer, such that a substrate extension projects beyond said junction;

depositing a layer of first dielectric to form a further waveguide region extending over said substrate extension and prior to depositing the first dielectric, depositing a second dielectric layer of refractive index below that of the

semiconductor and the first dielectric so that said second dielectric extends over the end face of the semiconductor waveguide and over the substrate extension, thereby forming a support layer for the first dielectric over the substrate extension, the thickness of the said second dielectric layer providing the required alignment of the optical area through the waveguide.

20. A method according to claim 19, wherein the semiconductor is silicon, the first dielectric is silicon nitride and said second dielectric layer is silicon dioxide.

21. A method according to claim 20, wherein the substrate comprises a layer of silicon dioxide over a layer of silicon.

22. A method according to claim 20 or 21, wherein the second dielectric layer and the silicon nitride layer are deposited such that they also extend over the top surface of the semiconductor waveguide.

23. A method according to any of claims 19 to 22, wherein an anti-reflective coating is deposited over the end face of the semiconductor waveguide before the second dielectric layer is deposited.

24. A method according to claim 20, wherein the anti-reflective coating is silicon nitride.

25. A method according to claim 23 or 24 in which the end face is curved.

26. A method according to any of claims 20 to 25, wherein the first dielectric layer is patterned.

27. A method according to any of claims 20 to 26, wherein the semiconductor and first dielectric form a common integrated waveguide device.

28. A method of biosensing using the interferometer of claim 15, comprising the steps of:

measuring a first interference amplitude with the silicon nitride section exposed to a reference environment, and then exposing the silicon nitride section to a test environment, and measuring a second interference amplitude, and providing a sensing result from selective values of said first and second amplitudes.

29. A method according to claim 28 comprising the further step of:

prior to measuring the said first interference amplitude, coating the silicon nitride section with a substance comprising a first protein, wherein if the test environment comprises a second protein, the second interference amplitude is dependent on the number of bonds formed between the first protein and the second protein.

30. A method according to claim 29, wherein one of the first protein and the second protein is an antibody.